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(54) **ASSOCIATED MOBILE ELEVATOR CALLS**

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G01S 1/08	(2006.01)

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See application file for complete search history.

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(57) **ABSTRACT**

A method of operating an elevator call control system comprising: receiving a first elevator call from a first individual carrying a first mobile device, the first elevator call including a destination request to travel from a first boarding floor to a first destination floor; determining that the first individual carrying the first mobile device is traveling with a second individual, wherein the second individual is traveling to a second destination floor; assigning an elevator car to the first elevator call; and scheduling the elevator car to transport the first individual carrying the first mobile device and the second individual together to at least one of a first destination floor and the second destination floor.

19 Claims, 4 Drawing Sheets
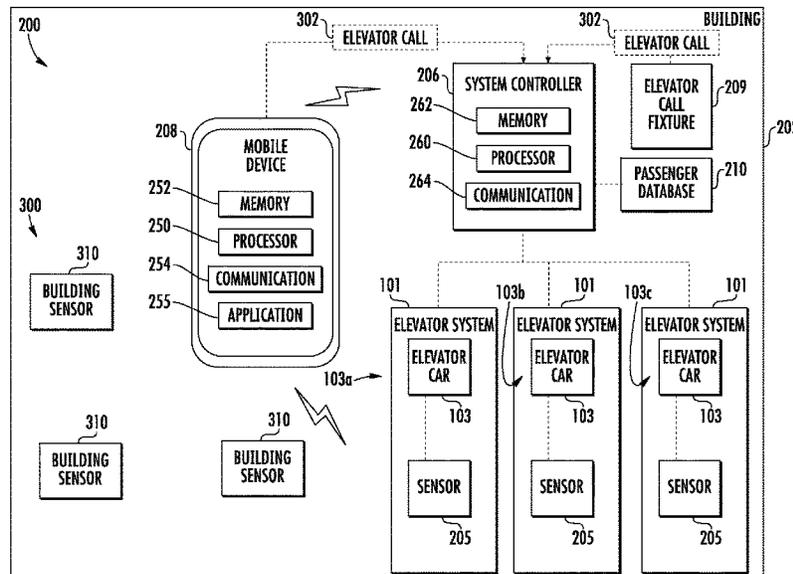
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101

111

113
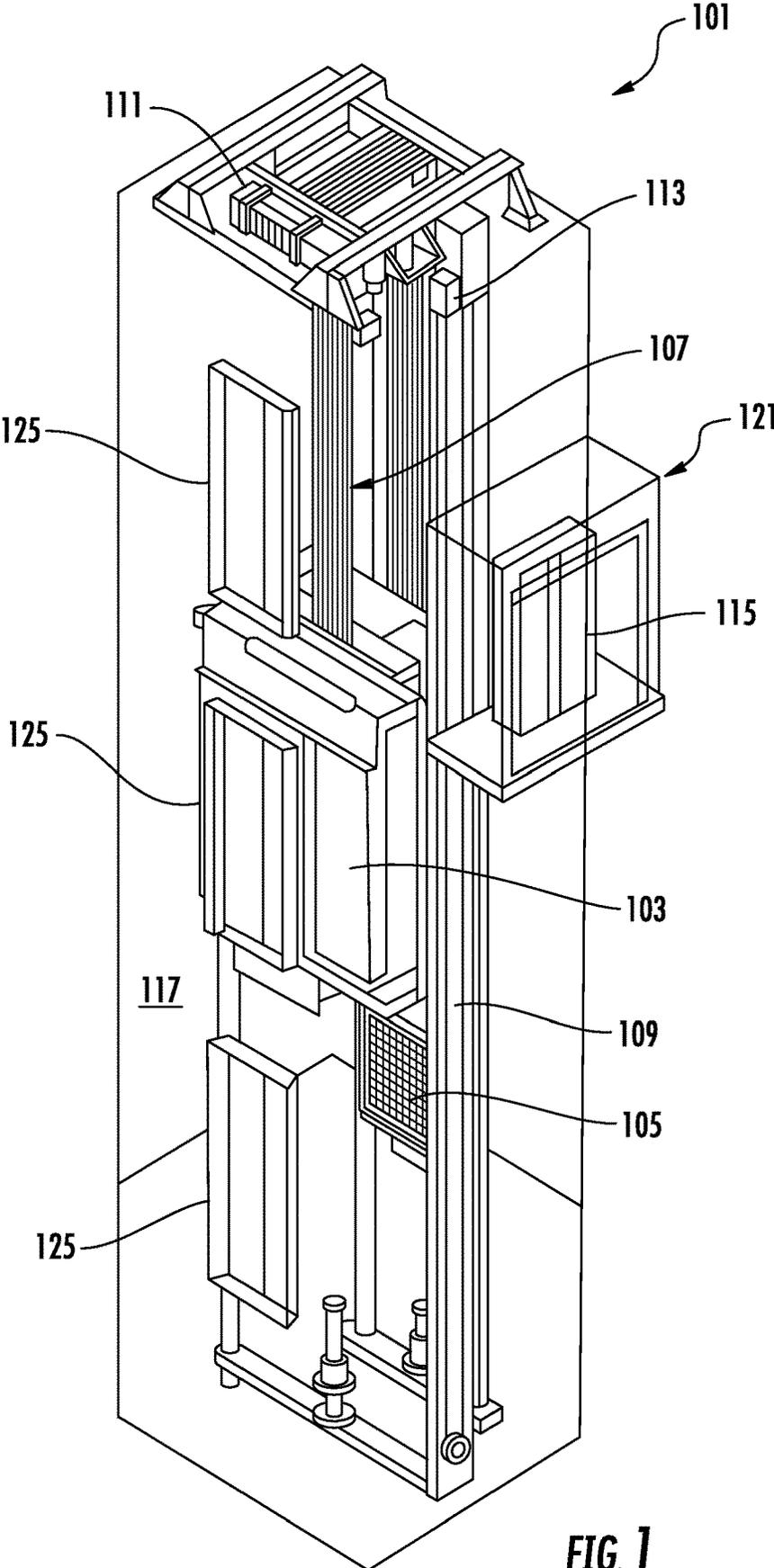
125

107

121

115

125

103

117

109

105

125

FIG. 1

FIG. 2

500

RECEIVING A FIRST ELEVATOR CALL FROM A FIRST INDIVIDUAL CARRYING A FIRST MOBILE DEVICE ⌐504

DETERMINING THAT THE FIRST INDIVIDUAL CARRYING THE FIRST MOBILE DEVICE IS TRAVELING WITH A SECOND INDIVIDUAL ⌐506

ASSIGNING AN ELEVATOR CAR TO THE FIRST ELEVATOR CALL ⌐508

SCHEDULING THE ELEVATOR CAR TO TRANSPORT THE FIRST INDIVIDUAL CARRYING THE FIRST MOBILE DEVICE AND THE SECOND INDIVIDUAL TOGETHER TO AT LEAST ONE OF A FIRST DESTINATION FLOOR AND A SECOND DESTINATION FLOOR ⌐510

FIG. 3

50
174

PASSENGERS TRAVELING TOGETHER ⌐208

FIRST PASSENGER ←178
BOARDING FLOOR
DESTINATION FLOOR
SECOND PASSENGER
BOARDING FLOOR
DESTINATION FLOOR

402

402

RETURN ALL PASSENGERS TRAVELING TOGETHER TO HOTEL ROOM ⌐208
←180

50
174

←178

TRANSPORT ALL PASSENGERS TRAVELING TOGETHER TO HOTEL LOBBY

FIG. 4

SENSOR 205

103

BUILDING SENSOR 310

302a

FIRST ELEVATOR CALL

BUILDING SENSOR 310

402a

208a

ELEVATOR CALL FIXTURE 209

125a

BUILDING SENSOR 310

117

BUILDING SENSOR 310

R1

BUILDING SENSOR 310

402b

208c

ELEVATOR CALL FIXTURE 209
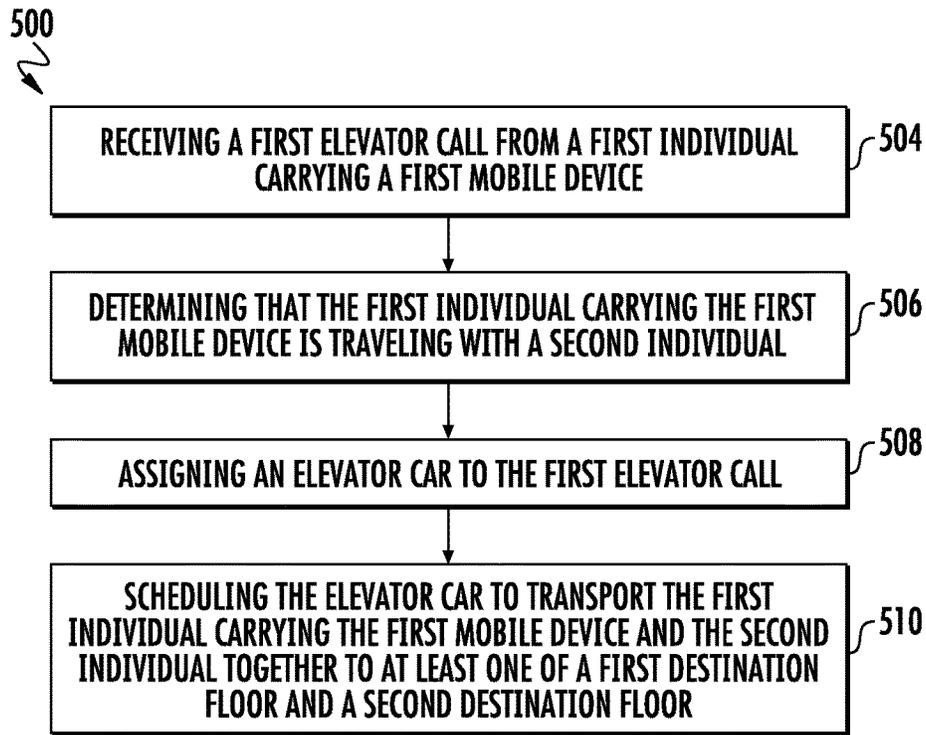
125b

BUILDING SENSOR 310

ELEVATOR CALL FIXTURE 209

125c
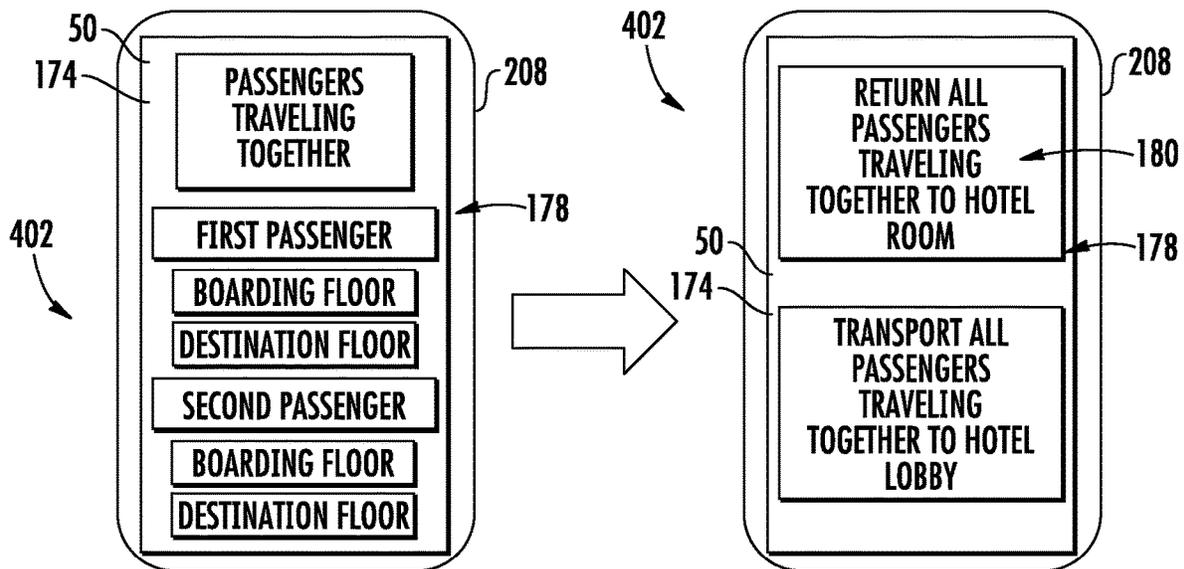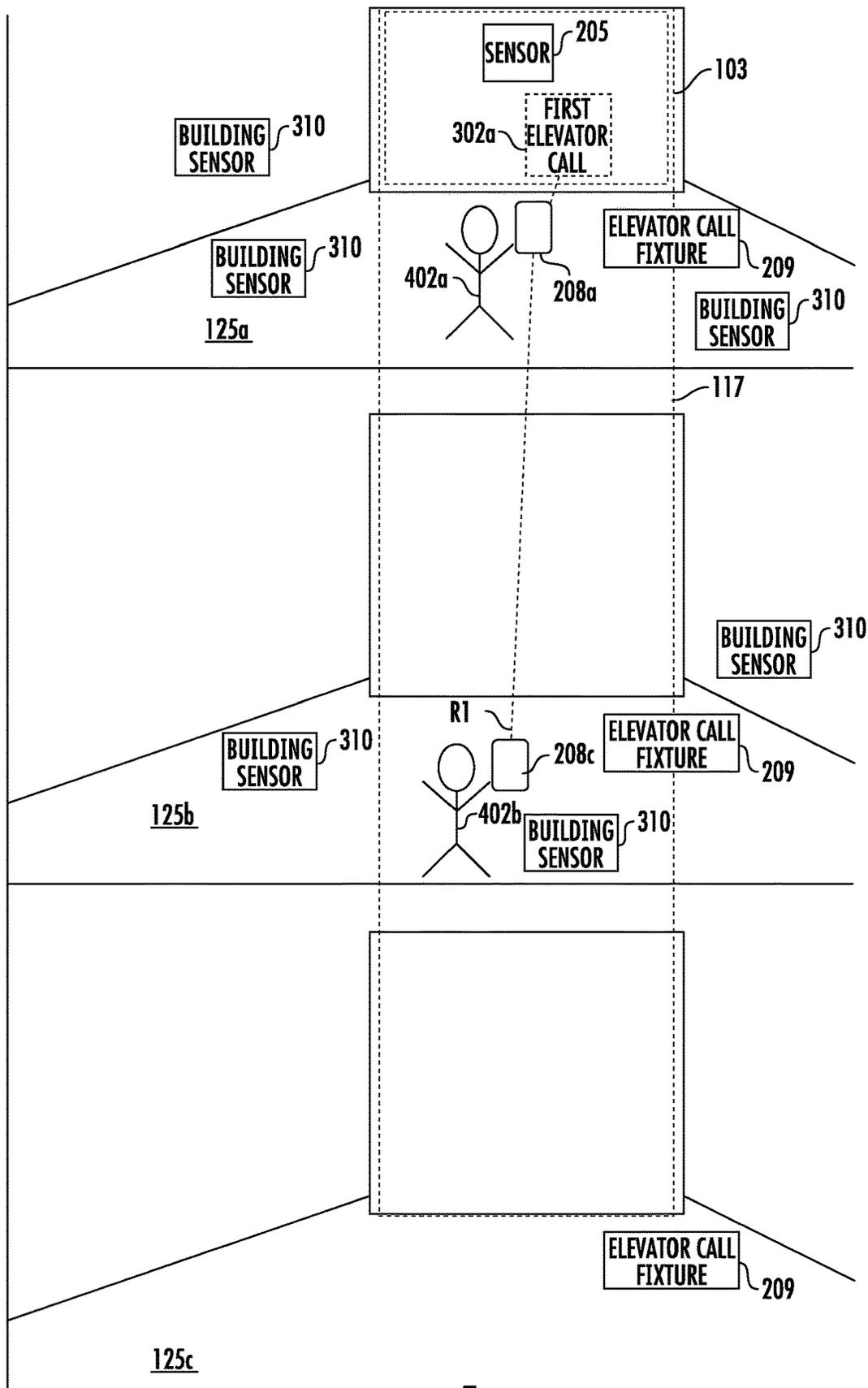
FIG. 5

ASSOCIATED MOBILE ELEVATOR CALLS

BACKGROUND

The subject matter disclosed herein generally relates to the field of elevator systems, and more particularly to an apparatus and method for calling elevator cars within the elevator system.

Existing elevator systems allow a user to submit an elevator call (e.g., a hall call or a destination call) using their own mobile device (e.g., a smartphone).

BRIEF SUMMARY

According to one embodiment, a method of operating an elevator call control system is provided. The method including: receiving a first elevator call from a first individual carrying a first mobile device, the first elevator call including a destination request to travel from a first boarding floor to a first destination floor; determining that the first individual carrying the first mobile device is traveling with a second individual, wherein the second individual is traveling to a second destination floor; assigning an elevator car to the first elevator call; and scheduling the elevator car to transport the first individual carrying the first mobile device and the second individual together to at least one of a first destination floor and the second destination floor.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that determining that the first individual carrying the first mobile device is traveling with a second individual further includes: receiving a selection input from the first mobile device indicating that the second individual is traveling with the first individual.

In addition to one or more of the features described above, or as an alternative, further embodiments may include: determining that the second individual is located on a second boarding floor different than the first boarding floor.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that determining that the second individual is located on a second boarding floor different than the first boarding floor further includes: receiving a selection input from the mobile device indicating that the second individual is located on a second boarding floor different than the first boarding floor.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that determining that the second individual is located on a second boarding floor different than the first boarding floor further includes: detecting a location of a second mobile device carried by the second individual.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that determining that the first individual carrying the first mobile device is traveling with a second individual further includes: detecting a location of a second mobile device carried by the second individual; detecting a location of the first mobile device; and determining that the second mobile device is within a selected range of the first mobile device.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that the second mobile device is determined to be within the selected range of the first mobile device when the first elevator call is received.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that the second mobile device is determined to be within the

selected range of the first mobile device when the elevator car arrives at the first boarding floor.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that determining that the first individual carrying the first mobile device is traveling with a second individual further includes: quarrying at least one of a social media network and a hotel visitor guest database to determine whether the second individual is traveling with the first individual.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that the first destination floor and the second destination floor are the same.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that the first destination floor and the second destination floor are different.

In addition to one or more of the features described above, or as an alternative, further embodiments may include: determining the first destination floor and the second destination floor.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that determining the first destination floor and the second destination floor further includes: receiving a selection input from the first mobile device indicating the first destination floor and the second destination floor.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that determining the first destination floor and the second destination floor further includes: quarrying at least one of a social media network and a hotel visitor guest database to determine the first destination floor and the second destination floor.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that detecting a location of the second mobile device further includes: connecting, using a building sensor, to the second mobile device via at least one of Wi-Fi and Bluetooth; and determining a distance between the building sensor and the second mobile device.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that detecting a location of the second mobile device further includes: detecting, using a building sensor, a wireless signal of the second mobile device, wherein the building sensor does not connect to the wireless signal; and determining a distance between the building sensor and the second mobile device.

In addition to one or more of the features described above, or as an alternative, further embodiments may include that detecting a location of the second mobile device further includes: detecting a beacon transmitted by a building sensor using the second mobile device; and determining a distance between the building sensor and the second mobile device in response to a strength of the beacon.

According to another embodiment, an elevator system including: an elevator car; and a system controller including: a processor; and a memory including computer-executable instructions that, when executed by the processor, cause the processor to perform operations, the operations including: receiving a first elevator call from a first individual carrying a first mobile device, the first elevator call including a destination request to travel from a first boarding floor to a first destination floor; determining that the first individual carrying the first mobile device is traveling with a second individual, wherein the second individual is traveling to a

second destination floor; assigning an elevator car to the first elevator call; and scheduling the elevator car to transport the first individual carrying the first mobile device and the second individual together to at least one of a first destination floor and the second destination floor.

According to another embodiment, a computer program product tangibly embodied on a computer readable medium is provided. The computer program product including instructions that, when executed by a processor, cause the processor to perform operations including: receiving a first elevator call from a first individual carrying a first mobile device, the first elevator call including a destination request to travel from a first boarding floor to a first destination floor; determining that the first individual carrying the first mobile device is traveling with a second individual, wherein the second individual is traveling to a second destination floor; assigning an elevator car to the first elevator call; and scheduling the elevator car to transport the first individual carrying the first mobile device and the second individual together to at least one of a first destination floor and the second destination floor.

Technical effects of embodiments of the present disclosure include determining how many other individuals piggy back on a single elevator call by tracking the location of mobile devices.

The foregoing features and elements may be combined in various combinations without exclusivity, unless expressly indicated otherwise. These features and elements as well as the operation thereof will become more apparent in light of the following description and the accompanying drawings. It should be understood, however, that the following description and drawings are intended to be illustrative and explanatory in nature and non-limiting.

BRIEF DESCRIPTION

The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

FIG. 1 is a schematic illustration of an elevator system that may employ various embodiments of the present disclosure;

FIG. 2 illustrates a schematic view of an elevator call control system, in accordance with an embodiment of the disclosure;

FIG. 3 is a flow diagram illustrating a method of operating an elevator call control system, according to an embodiment of the present disclosure;

FIG. 4 illustrates a graphical user interface of a mobile device within the elevator call control system of FIG. 2, according to an embodiment of the present disclosure; and

FIG. 5 illustrates a graphical illustration of the method of FIG. 3, according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

FIG. 1 is a perspective view of an elevator system 101 including an elevator car 103, a counterweight 105, a tension member 107, a guide rail 109, a machine 111, a position reference system 113, and a controller 115. The elevator car 103 and counterweight 105 are connected to each other by the tension member 107. The tension member 107 may

include or be configured as, for example, ropes, steel cables, and/or coated-steel belts. The counterweight 105 is configured to balance a load of the elevator car 103 and is configured to facilitate movement of the elevator car 103 concurrently and in an opposite direction with respect to the counterweight 105 within an elevator shaft 117 and along the guide rail 109.

The tension member 107 engages the machine 111, which is part of an overhead structure of the elevator system 101. The machine 111 is configured to control movement between the elevator car 103 and the counterweight 105. The position reference system 113 may be mounted on a fixed part at the top of the elevator shaft 117, such as on a support or guide rail, and may be configured to provide position signals related to a position of the elevator car 103 within the elevator shaft 117. In other embodiments, the position reference system 113 may be directly mounted to a moving component of the machine 111, or may be located in other positions and/or configurations as known in the art. The position reference system 113 can be any device or mechanism for monitoring a position of an elevator car and/or counter weight, as known in the art. For example, without limitation, the position reference system 113 can be an encoder, sensor, or other system and can include velocity sensing, absolute position sensing, etc., as will be appreciated by those of skill in the art.

The controller 115 is located, as shown, in a controller room 121 of the elevator shaft 117 and is configured to control the operation of the elevator system 101, and particularly the elevator car 103. For example, the controller 115 may provide drive signals to the machine 111 to control the acceleration, deceleration, leveling, stopping, etc. of the elevator car 103. The controller 115 may also be configured to receive position signals from the position reference system 113 or any other desired position reference device. When moving up or down within the elevator shaft 117 along guide rail 109, the elevator car 103 may stop at one or more landings 125 as controlled by the controller 115. Although shown in a controller room 121, those of skill in the art will appreciate that the controller 115 can be located and/or configured in other locations or positions within the elevator system 101. In one embodiment, the controller may be located remotely or in the cloud.

The machine 111 may include a motor or similar driving mechanism. In accordance with embodiments of the disclosure, the machine 111 is configured to include an electrically driven motor. The power supply for the motor may be any power source, including a power grid, which, in combination with other components, is supplied to the motor. The machine 111 may include a traction sheave that imparts force to tension member 107 to move the elevator car 103 within elevator shaft 117.

Although shown and described with a roping system including tension member 107, elevator systems that employ other methods and mechanisms of moving an elevator car within an elevator shaft may employ embodiments of the present disclosure. For example, embodiments may be employed in ropeless elevator systems using a linear motor to impart motion to an elevator car. Embodiments may also be employed in ropeless elevator systems using a hydraulic lift to impart motion to an elevator car. FIG. 1 is merely a non-limiting example presented for illustrative and explanatory purposes.

FIG. 2 depicts an elevator call control system 200 in an example embodiment. The elevator call control system 200 includes one or more elevator system 101 installed at a building 202. In some embodiments, the building 202 may

be a building or a collection of buildings that may or may not be physically located near each other. The building **202** may include any number of floors. Persons entering the building **202** may enter at a lobby floor, or any other floor, and may go to a destination floor via one or more conveyance devices, such as the elevator system **101**.

The elevator system **101** may be operably connected to one or more computing devices, such as a system controller **206**. The system controller **206** may be configured to control dispatching operations for one or more elevator cars **103** associated with one or more elevator systems **101**. It is understood that the elevator system **101** may utilize more than one system controller **206**. Although three elevator systems **101** are shown in FIG. **2**, it is understood that any number of elevator systems **101** may be utilized. Additional, although each elevator system **101** is illustrated as having one elevator car **103**, it is understood that any number of elevators cars **103** may be used each elevator system **101**. The elevator cars **103** of FIG. **2** may be referred to also as a first elevator car **103***a*, a second elevator car **103***b*, and a third elevator car **103***c*. It is understood that other components of the elevator system **101** (e.g., drive, counterweight, safeties, etc.) are not depicted for ease of illustration in FIG. **2**.

The system controller **206** may include a processor **260**, memory **262** and communication module **264**, as shown in FIG. **2**. The processor **260** can be any type or combination of computer processors, such as a microprocessor, microcontroller, digital signal processor, application specific integrated circuit, programmable logic device, and/or field programmable gate array. The memory **262** is an example of a non-transitory computer readable storage medium tangibly embodied in the system controller **206** including executable instructions stored therein, for instance, as firmware. The communication module **264** may implement one or more communication protocols as described in further detail herein.

The system controller **206** may include and/or be in electronic communication with a passenger database **210**. The passenger database **210** may be local and/or remote to the system controller **206**. Although, only shown as a single database, the passenger database **210** may comprise multiple individual databases that are each either local or remote. The system controller **206** may be connected to the passenger database **210** through a cloud computing network or any other desired communication system. The passenger database **206** may container information regarding relationships among passengers that may take an elevator car **103** of the elevator call control system **200**. For example, the passenger database **206** may contain information indicating whether two or more passengers may desire to travel together within a single elevator car **103**. For example, the two passengers may be family, teammates, friends, coworkers, partners, or the passengers may have any other relationship status that may indicate that they would like to share an elevator car **103**. In one embodiment, the passenger database **110** is a meeting calendar/schedule that may know when one or more passengers intend to travel together to the same meeting or away from the same meeting. In one embodiment, the passenger database **110** is a social media network. In one embodiment, the passenger database **110** is a hotel visitor guest database or an employer database. For example, when checking in to a hotel or creating a hotel account, an individual may identify other individuals that they will be traveling with during their stay at the hotel. In another example, the passenger database **110** may also include employment information, such as, for example, where the

passenger works, what group the passenger works in, what is the passenger's employment rank in the business. The passenger database **210** also may include the floors (i.e., landings) where potential passengers of the elevator car **103** may be staying in at hotel or floors where potential passengers will working on in an office building.

Also shown in FIG. **2** is a mobile device **208**. The mobile device **208** may be a mobile computing device that is typically carried by a person, such as, for example a smart phone, PDA, smart watch, tablet, laptop, etc. The mobile device **208** may include a touch screen (not shown). The mobile device **208** may include a processor **250**, memory **252** and communication module **254** as shown in FIG. **2**. The processor **250** can be any type or combination of computer processors, such as a microprocessor, microcontroller, digital signal processor, application specific integrated circuit, programmable logic device, and/or field programmable gate array. The memory **252** is an example of a non-transitory computer readable storage medium tangibly embodied in the mobile device **208** including executable instructions stored therein, for instance, as firmware. The communication module **254** may implement one or more communication protocols as described in further detail herein. The mobile device **208** belongs to a resident or employee of the building **202** who currently has access to the elevator system **101**.

Each mobile device **208** may transmit an elevator call **302** to the system controller **206** and the system controller **206** will move an elevator car **103** in response to the elevator call **302**. The elevator call **302** may also be transmitted from an elevator call fixture **209**. The elevator call fixture **209** may be located in an elevator lobby proximate the elevator system **101**. The elevator call fixture **209** may be stationary. Multiple different individuals may submit an elevator call **302** via the elevator call fixture **209**.

The elevator call **302** may include a "boarding floor" and a "destination floor." The "boarding floor" is where the person with the mobile device **208** desires to board the elevator car **103** and the "destination floor" is where the person with the mobile device **208** intends to travel. In one embodiment, the elevator call **302** may only include the "destination floor" and the "boarding floor" may be automatically determined by the elevator system **101**. Embodiments herein generate a graphical user interface on the mobile device **208** through an application **255**. The mobile device **208** may transmit an elevator call **302** through an application **255**.

The mobile device **208** and the system controller **206** communicate with one another. For example, the mobile device **208** and the system controller **206** may communicate with one another when proximate to one another (e.g., within a threshold distance). The mobile device **208** and the system controller **206** may communicate over a wireless network, such as 802.11x (Wi-Fi), short-range radio (Bluetooth), cellular, satellite, etc. In some embodiments, the system controller **206** may include, or be associated with (e.g., communicatively coupled to) a networked element, such as kiosk, beacon, hall call fixture, lantern, bridge, router, network node, door lock, elevator control panel, building intercom system, etc. The networked element may communicate with the mobile device **208** using one or more communication protocols or standards. For example, the networked element may communicate with the mobile device **208** using near field communications (NFC). A connection between the mobile device **208** and the system controller **206** may be direct between mobile device **208** and system controller **206** or it may be through a web service.

The connection also may include security elements such as VPN or authentication or encryption. In other embodiments, the system controller **206** may establish connection with a mobile device **208** that is inside and/or outside of the building **202** in order to detect a location of the mobile device **208**. A location of the mobile device may be determined using various technologies including GPS, triangulation, trilateration, signal strength detection, accelerometer detection, gyroscopic detection, or barometric pressure sensing by way of non-limiting example. The triangulation and trilateration may use various wireless technologies including but not limited to Wi-Fi and Bluetooth. In example embodiments, the mobile device **208** communicates with the system controller **206** over multiple independent wired and/or wireless networks. Embodiments are intended to cover a wide variety of types of communication between the mobile device **208** and system controller **206**, and embodiments are not limited to the examples provided in this disclosure. Communication between the mobile device **208** and the system controller **206** will allow the system controller **206** to determine the location of the mobile device **208** in relation to the elevator system **101**. The location of the mobile device **208** may be communicated to the system controller **206** through a plurality of sensors **205**, discussed further below.

Each elevator system **101** may also include a sensor **205** configured to detect whether a mobile device **208** has entered the elevator car **103**. In an embodiment, the sensor **205** may be located on the elevator car **103**. The system controller **206** is in electronic communication with each sensor **205** through a wired connection and/or wireless connection. In an alternative embodiment, each sensor may be in indirect communication with the system controller **206** through the mobile device **208**. In a non-limiting example, if the sensors **205** are a Bluetooth beacon, then the mobile device **208** can detect when it is in proximity of the sensor **205**, then the mobile device **208** can communicate with the system controller **206** that it is in the elevator car **103**.

Further, although only one sensor **205** is shown per elevator car **103** for ease of illustration it is understood that each elevator car **103** may contain one or more sensors **205**. Each sensor **205** may also be configured to detect operational data of the elevator car **103**, such as for example, elevator door position (e.g. open/closed), elevator car location, speed, voltage, vibration, acceleration, noise, deceleration, jerk, and any other performance parameter of any component of the elevator system **103** known to one of skill in the art.

The sensors **205** detect the presence of an individual in an elevator car **103** and identify the individual using various sensing technology, such as, for example Wi-Fi transceivers, Bluetooth transceivers, radio transceivers, visual recognition cameras, people counters, microphones, etc. to detect persons and/or mobile devices entering and leaving the elevator car. The type and nature of sensors **205** within the sensor system **101** is not limited to the embodiments disclosed herein. The mobile device **208** and the sensors **205** communicate with one another. For example, the mobile device **208** and the sensors **205** may communicate with one another when proximate to one another (e.g., within a threshold distance). The mobile device **208** and the sensors **205** may communicate over a wireless network, such as 802.11x (Wi-Fi), ZigBee, Z-Wave and short-range radio (Bluetooth).

In an embodiment, the sensors **205** may include a Wi-Fi transceiver to connect to a mobile device **208** when the mobile device **208** enters the elevator car **103** in order to identify the mobile device **208**. In another embodiment, the sensors **205** may include a Bluetooth transceiver to connect to a mobile device **208** when the mobile device **208** enters the elevator car **103** in order to identify the mobile device **208**. The sensors **205** are configured to detect a distance between the elevator car **103** and the mobile device **208** to determine whether the mobile device **208** is entering and/or leaving the elevator car **103**. The sensors **205** may be configured to detect a distance between the elevator car **103** and the mobile device **208** through wireless signal strength detection.

Communication between the mobile device **208** and the sensors **205** can be one-way or two-way communication. In one example, if Bluetooth is utilized then the mobile device **208** may advertise a Bluetooth signal and the sensors **205** may receive it. In another example, the sensors **205** may advertise a Bluetooth signal and the mobile device **208** may receive it. In another example, there may be two-way Bluetooth communication between the sensors **205** and the mobile device **208**. In another example, a Wi-Fi transceiver (i.e. sensor **205**) may be placed in an elevator car and the mobile device may detect the Wi-Fi beacon frame as part of the 802.11x protocol as well as the received signal strength of that beacon frame to approximate the distance between the Wi-Fi transceiver and the mobile device **208** but not connect to the Wi-Fi signal. In another example, the mobile device **208** may actively send a probe request looking for Wi-Fi transceivers, then a Wi-Fi transceiver (i.e. sensor **205**) located in an elevator car may extract the MAC address of the mobile device **208** from the probe request and approximate distance between the Wi-Fi transceiver and the mobile device **208** from received signal strength.

In another embodiment, the mobile device **208** and the sensors **205** may communicate over a non-radio frequency network. In an example the mobile device **208** and the sensors **205** may communicate through audio transmission, such as, for example a high frequency audio transmission. The mobile device **208** may emit a chirp signature between 15 kHz-20 kHz that one or more microphones (i.e. sensor **205**) can detect and extract a signature to determine which mobile device **208** is present. In this example, Audio gain at speaker may be measured to a distance between the microphone and the mobile device **208** may be determined in response to the audio gain. Advantageously, more microphones may help better determine distance. Alternatively, the speakers (i.e. sensors **205**) may be located in the elevators car **103** and may emit the high frequency audit for the mobile device **208** to detect. Advantageously, one or more speakers may be help better determine distance.

The elevator call control system **200** may also include an indoor positioning system **300** comprising one or more building sensors **310** in electronic communication with the system controller **206**. In an embodiment, the indoor positioning system **300** may be configured to determine how many individuals carrying mobile devices **208** are waiting for an elevator car **103** in an elevator lobby. For example, a single individual may have submitted an elevator call **302** but five individuals are planning on boarding the elevator car **103** when it arrives to pick up the individuals, which is a process known as piggy backing because the five individuals will be "piggy backing" on the elevator call **302** submitted by the single individual.

The building sensors **310** may be located throughout the building **202**. The building sensors **310** may be located proximate an elevator shaft **117** of each elevator system **101**. Each building sensor **310** may be configured to emit and/or detect a wireless signal. The building sensor **310** may be configured to emit a wireless signal that may be detected by the mobile device **208**. The building sensor **310** may be able

to detect a wireless signal emitted by mobile device 208. In an embodiment, a building sensor 310 may be a door lock that controls access to a room within the building 202. In an embodiment, a building sensor 310 may be a wireless access protocol device that provides Wi-Fi access to computing devices throughout the building 202.

The building sensors 310 may detect the location of the mobile device 208 within a building 202 using various sensing technology, such as, for example Wi-Fi transceivers, Bluetooth transceivers, radio transceivers, etc. to detect the presence of mobile devices 208 within the building 202. The type and nature of building sensors 310 within the sensor system 101 is not limited to the embodiments disclosed herein. The mobile device 208 and the building sensors 310 communicate with one another. For example, the mobile device 208 and the building sensors 310 may communicate with one another when proximate to one another (e.g., within a threshold distance). The mobile device 208 and the building sensors 310 may communicate over a wireless network, such as 802.11x (Wi-Fi), ZigBee, Z-Wave and short-range radio (Bluetooth).

In an embodiment, the building sensors 310 may include a Wi-Fi transceiver to connect to a mobile device 208 when the mobile device 208 is located within a threshold distance in order to determine the location of the mobile device 208. In another embodiment, the building sensors 310 may include a Bluetooth transceiver to connect to a mobile device 208 when the mobile device 208 is located within a threshold distance in order to determine the location of the mobile device 208. The building sensors 310 may be configured to detect a distance between each of the building sensor 310 and the mobile device 208 through wireless signal strength detection. The wireless signal strength detected between the mobile device 208 and a single building sensor 310 may be enough to approximate a location of the mobile device 208 or the indoor positioning system 300 may utilize three or more building sensors 310 to triangulate the position of the mobile device 208 utilizing the wireless signal strength detected between the mobile device 208 and each of the three building sensors 310.

Communication between the mobile device 208 and the building sensors 310 can be one-way or two-way communication. In one example, if Bluetooth is utilized then the mobile device 208 may advertise a Bluetooth signal and the building sensors 310 may receive it. In another example, the building sensors 310 may advertise a Bluetooth signal and the mobile device 208 may receive it. In another example, there may be two-way Bluetooth communication between the building sensors 310 and the mobile device 208. In another example, a the building sensor 310 may be a Wi-Fi transceiver (i.e., a wireless access protocol device) and the mobile device 208 may detect the Wi-Fi beacon frame as part of the 802.11x protocol as well as the received signal strength of that beacon frame to approximate the distance between the Wi-Fi transceiver and the mobile device 208 but not connect to the Wi-Fi signal. In another example, the mobile device 208 may actively send a probe request looking for Wi-Fi transceivers, then a Wi-Fi transceiver (i.e. building sensor 310) may extract the MAC address of the mobile device 208 from the probe request and approximate distance between the Wi-Fi transceiver and the mobile device 208 from received signal strength.

In one embodiment, the mobile device 208 may determine a distance between the mobile device 208 and each of the building sensors 310 and transmit that distance to the system controller 206 to determine the location of the mobile device 208. In another embodiment, the indoor positioning system

300 may determine a distance between the mobile device 208 and each of the building sensors 310 and transmit that distance to the system controller 206 to determine the location of the mobile device 208. The location of the mobile device 208 may be determined by the mobile device 208 or by the indoor positioning system 300. In one embodiment, the mobile device 208 may determine a distance between the mobile device 208 and each of the building sensors 310, then the mobile device 208 may use that distance to determine the location of the mobile device 208 to transmit to the system controller 206. In another embodiment, the indoor positioning system 300 may determine a distance between the mobile device 208 and each of the building sensors 310, then the indoor positioning system 300 may use that distance to determine the location of the mobile device 208 to transmit to the system controller 206.

Referring now to FIG. 3-5 with continued reference to FIGS. 1-2. FIG. 3 shows a flow chart of a method 500 of operating an elevator call control system 200. The method 500 may be performed by system controller 206. FIG. 4 illustrates a mobile device 208 graphical user interface 178 for operating the application 255. FIG. 5 illustrates a graphical representation of the method 500. The mobile device 208 may be a laptop computer, smart phone, tablet computer, smart watch, or any other mobile computing device known to one of skill in the art. In the example shown in FIG. 4, the mobile device 208 is a touchscreen smart phone. The mobile device 208 may include a display screen 174 and an input device 50, such as, example, a mouse, a touch screen, a scroll wheel, a scroll ball, a stylus pen, a microphone, a camera, etc. In the example shown in FIG. 4, since the mobile device 208 is a touchscreen smart phone, then the display screen 174 may also function as an input device 50. FIG. 4 illustrates a graphical user interface 178 on the mobile device 208. A user may interact with the graphical user interface 178 through a selection input, such as, for example, a "click", "touch", verbal command or any other input to the user interface 178.

A first individual 402a making an elevator call 302 may identify one or more other individuals traveling with the first individual 402a using the user interface 178 of the application 255. Alternatively, the application 255 may automatically identify and prepopulate the one or more other individuals traveling with the first individual 402a using the passenger database 210 and/or location determination of mobile devices 208 belonging to the one or more other individuals then display the one or more individuals on the display screen 174, as seen in FIG. 4 at 402. Once the first individual 402a and the one or more other individuals are displayed on the display screen 174, the first individual 402a may adjust the one or more other individuals through the graphical user interface 178 of the application 255.

Additionally, the first individual 402a making an elevator call 302 may identify the boarding floor and destination floor of the first individual 402a and the one or more other individuals traveling with the first individual 402a using the user interface 178 of the application 255. Alternatively, the application 255 may automatically identify and prepopulate the boarding floor and destination floor of the first individual and the one or more other individuals traveling with the first individual 402a using the passenger database 210 and/or location determination of mobile devices 208 belonging to the one or more other individuals then display the boarding floors and destination floors are displayed on the display screen 174, as seen in FIG. 4 at 402. Once the boarding floors and destination floors are displayed on the display

screen **174**, the first individual **402a** may adjust the one or more other individuals through the graphical user interface **178** of the application **255**.

The application **255** may also be configured to display short cut buttons **180** through the user interface **178** on the display screen **174**, as shown at **404** in FIG. **4**. For instance, the short cut buttons **180** may include short cuts such as, for example, "RETURN ALL PASSENGERS TRAVELING TOGETHER TO HOTEL ROOM" AND "TRANSPORT ALL PASSENGERS TRAVELING TOGETHER TO HOTEL LOBBY". An individual may select one of the shortcut buttons **180** to automatically generate an elevator call **302** so that all the passengers identified as travelling together in the passenger database **210** may travel within the same elevator car **103**.

At block **504**, a first elevator call **302a** is received from a first individual **402a** carrying a first mobile device **208a**. The first elevator call **302a** includes a destination request to travel from a first boarding floor **125a** to a first destination floor. The first mobile device **208a** may be determined to be located on the first boarding floor **125a** by receiving a selection input from the first mobile device **208a** and/or detecting a location of the first mobile device **208a**. The location of the first mobile device **208a** may be detected utilizing the building sensors **310**, the sensor **205** of an elevator car **103**, and/or a second mobile device **208b**. In one example, the location of the first mobile device **208a** may be determined by: connecting, using a building sensor **310**, to the first mobile device **208a** via at least one of Wi-Fi and Bluetooth; and determining a distance between the building sensor **310** and the first mobile device **208a**. In another example, the location of the first mobile device **208a** may be determined by: detecting, using a building sensor **310**, a wireless signal of the first mobile device **208a**, wherein the building sensor **310** does not connect to the wireless signal; and determining a distance between the building sensor **310** and the first mobile device **208a**. In yet another example, the location of the first mobile device **208a** may be determined by: detecting a beacon transmitted by a building sensor **310** using the first mobile device **208a**; and determining a distance between the building sensor **310** and the first mobile device **208a** in response to a strength of the beacon.

At block **506**, it is determined that the first individual **402a** carrying the first mobile device **208a** is traveling with a second individual **402b**. It may be determined that the first individual **402a** carrying the first mobile device **208a** is traveling with a second individual **402b** by: receiving a selection input from the first mobile device **208a** indicating that the second individual **402b** is traveling with the first individual **402a**. It may be determined that the first individual **402a** carrying the first mobile device **208a** is traveling with a second individual **402b** further comprises: detecting a location of a second mobile device **208b** carried by the second individual **402b**; detecting a location of the first mobile device **208a**; and determining that the second mobile device **208b** is within a selected range R1 of the first mobile device **208a**. The second mobile device **208b** may be determined to be within a selected range R1 of the first mobile device **208a** when the first elevator call **302a** is received and/or when the elevator car **103** arrives at the first boarding floor **125a**. It may also be determined that the first individual **402a** carrying the first mobile device **208a** is traveling with a second individual **402b** by: quarrying at least one of a social media network and a hotel visitor guest database to determine whether the second individual **402b** is traveling with the first individual **402a**.

At block **508**, an elevator car **103** is assigned to the first elevator call **302a**. At block **510**, the elevator car **103** is scheduled to transport the first individual **402a** carrying the first mobile device **208a** and the second individual **402b** together to at least one of a first destination floor and a second destination floor. In an embodiment, the first destination floor is the second destination floor (e.g., the first destination floor and the second destination floor are a hotel lobby, a ground floor, gym floor, pool floor, or conference room floor). In the example shown in FIG. **5**, the first destination floor and the second destination floor are a ground floor **125c**.

The elevator car **103** may be scheduled to pick up the first individual **402a** and the second individual **402b** on the same floor or scheduled to pick up the first individual **402a** and the second individual **402b** on different floors, such that the first individual **402a** and the second individual **402b** travel together within the elevator car **103** at some point between their origin and destinations. Further, The elevator car **103** may be scheduled to transport the first individual **402a** and the second individual **402b** to the same floor or scheduled to transport the first individual **402a** and the second individual **402b** to different floors, such that the first individual **402a** and the second individual **402b** travel together within the elevator car **103** at some point between their origin and destinations.

The method **500** may further comprise: determining that the second individual **402b** is located on a second boarding floor **125b**. The second boarding floor **125b** may be different than the first boarding floor **125a** as shown in FIG. **5**. Alternatively, the second boarding floor may also be the same as the first boarding floor (not shown), the first individual **402a** and the second individual **402b** may board the elevator car on the same boarding floor. It may be determined that the second individual **402b** is located on a second boarding floor **125b** different than the first boarding floor **125a** by: receiving a selection input from the mobile device indicating that the second individual **402b** is located on a second boarding floor **125b** different than the first boarding floor **125a**. It may be determined that the second individual **402b** is located on a second boarding floor **125b** different than the first boarding floor **125a** by: detecting a location of a second mobile device **208b** carried by the second individual **402b**.

The location of the second mobile device **208b** may be detected utilizing the building sensors **310**, the sensor **205** of an elevator car **103**, and/or the first mobile device **208a**. In one example, the location of the second mobile device **208b** may be determined by: connecting, using a building sensor **310**, to the second mobile device **208b** via at least one of Wi-Fi and Bluetooth; and determining a distance between the building sensor **310** and the second mobile device **208b**. In another example, the location of the second mobile device **208b** may be determined by: detecting, using a building sensor **310**, a wireless signal of the second mobile device **208b**, wherein the building sensor **310** does not connect to the wireless signal; and determining a distance between the building sensor **310** and the second mobile device **208b**. In yet another example, the location of the second mobile device **208b** may be determined by: detecting a beacon transmitted by a building sensor **310** using the second mobile device **208b**; and determining a distance between the building sensor **310** and the second mobile device **208b** in response to a strength of the beacon.

While the above description has described the flow process of FIG. **3** in a particular order, it should be appreciated

that unless otherwise specifically required in the attached claims that the ordering of the steps may be varied.

As described above, embodiments can be in the form of processor-implemented processes and devices for practicing those processes, such as a processor. Embodiments can also be in the form of computer program code containing instructions embodied in tangible media, such as network cloud storage, SD cards, flash drives, floppy diskettes, CD ROMs, hard drives, or any other computer-readable storage medium, wherein, when the computer program code is loaded into and executed by a computer, the computer becomes a device for practicing the embodiments. Embodiments can also be in the form of computer program code, for example, whether stored in a storage medium, loaded into and/or executed by a computer, or transmitted over some transmission medium, loaded into and/or executed by a computer, or transmitted over some transmission medium, such as over electrical wiring or cabling, through fiber optics, or via electromagnetic radiation, wherein, when the computer program code is loaded into an executed by a computer, the computer becomes an device for practicing the embodiments. When implemented on a general-purpose microprocessor, the computer program code segments configure the microprocessor to create specific logic circuits.

The term "about" is intended to include the degree of error associated with measurement of the particular quantity based upon the equipment available at the time of filing the application. For example, "about" can include a range of ±8% or 5%, or 2% of a given value.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, element components, and/or groups thereof.

While the present disclosure has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the present disclosure. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present disclosure without departing from the essential scope thereof. Therefore, it is intended that the present disclosure not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this present disclosure, but that the present disclosure will include all embodiments falling within the scope of the claims.

What is claimed is:

1. A method of operating an elevator call control system, the method comprising:

receiving a first elevator call from a first individual carrying a first mobile device, the first elevator call including a destination request to travel from a first boarding floor to a first destination floor;

determining that the first individual carrying the first mobile device is traveling with a second individual, wherein the second individual is traveling to a second destination floor;

assigning an elevator car to the first elevator call; and

scheduling the elevator car to transport the first individual carrying the first mobile device and the second individual together to at least one of a first destination floor and the second destination floor.

2. The method of claim 1, wherein determining that the first individual carrying the first mobile device is traveling with a second individual further comprises:

receiving a selection input from the first mobile device indicating that the second individual is traveling with the first individual.

3. The method of claim 1, further comprising:

determining that the second individual is located on a second boarding floor different than the first boarding floor.

4. The method of claim 3, wherein determining that the second individual is located on a second boarding floor different than the first boarding floor further comprises:

receiving a selection input from the mobile device indicating that the second individual is located on a second boarding floor different than the first boarding floor.

5. The method of claim 3, wherein determining that the second individual is located on a second boarding floor different than the first boarding floor further comprises:

detecting a location of a second mobile device carried by the second individual.

6. The method of claim 1, wherein determining that the first individual carrying the first mobile device is traveling with a second individual further comprises:

detecting a location of a second mobile device carried by the second individual;

detecting a location of the first mobile device; and

determining that the second mobile device is within a selected range of the first mobile device.

7. The method of claim 6, wherein the second mobile device is determined to be within the selected range of the first mobile device when the first elevator call is received.

8. The method of claim 6, wherein the second mobile device is determined to be within the selected range of the first mobile device when the elevator car arrives at the first boarding floor.

9. The method of claim 1, wherein determining that the first individual carrying the first mobile device is traveling with a second individual further comprises:

quarrying at least one of a social media network and a hotel visitor guest database to determine whether the second individual is traveling with the first individual.

10. The method of claim 1, wherein the first destination floor and the second destination floor are the same.

11. The method of claim 1, wherein the first destination floor and the second destination floor are different.

12. The method of claim 1, further comprising:

determining the first destination floor and the second destination floor.

13. The method of claim 12, wherein determining the first destination floor and the second destination floor further comprises:

receiving a selection input from the first mobile device indicating the first destination floor and the second destination floor.

14. The method of claim 12, wherein determining the first destination floor and the second destination floor further comprises:

quarrying at least one of a social media network and a hotel visitor guest database to determine the first destination floor and the second destination floor.

15. The method of claim 5, wherein detecting a location of the second mobile device further comprises:

connecting, using a building sensor, to the second mobile device via at least one of Wi-Fi and Bluetooth; and

determining a distance between the building sensor and the second mobile device.

16. The method of claim 5, wherein detecting a location of the second mobile device further comprises:

detecting, using a building sensor, a wireless signal of the second mobile device, wherein the building sensor does not connect to the wireless signal; and

determining a distance between the building sensor and the second mobile device.

17. The method of claim 5, wherein detecting a location of the second mobile device further comprises:

detecting a beacon transmitted by a building sensor using the second mobile device; and

determining a distance between the building sensor and the second mobile device in response to a strength of the beacon.

18. An elevator system comprising:

an elevator car; and

a system controller comprising:

a processor; and

a memory comprising computer-executable instructions that, when executed by the processor, cause the processor to perform operations, the operations comprising:

receiving a first elevator call from a first individual carrying a first mobile device, the first elevator

call including a destination request to travel from a first boarding floor to a first destination floor;

determining that the first individual carrying the first mobile device is traveling with a second individual, wherein the second individual is traveling to a second destination floor;

assigning an elevator car to the first elevator call; and

scheduling the elevator car to transport the first individual carrying the first mobile device and the second individual together to at least one of a first destination floor and the second destination floor.

19. A computer program product tangibly embodied on a computer readable medium, the computer program product including instructions that, when executed by a processor, cause the processor to perform operations comprising:

receiving a first elevator call from a first individual carrying a first mobile device, the first elevator call including a destination request to travel from a first boarding floor to a first destination floor;

determining that the first individual carrying the first mobile device is traveling with a second individual, wherein the second individual is traveling to a second destination floor;

assigning an elevator car to the first elevator call; and

scheduling the elevator car to transport the first individual carrying the first mobile device and the second individual together to at least one of a first destination floor and the second destination floor.

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